5 pgs

TITLE OF THE INVENTION

METHOD FOR PROVIDING CANVAS OF PAPER-MAKING MACHINE WITH ANTI-STAINING AGENT THROUGH SPRINKLING, AND SLIDING SPRINKLE DEVICE AND ANTI-STAINING AGENT FOR USE THEREIN

TECHNICAL FIELD

The present invention relates to a method of spraying antipollution agent to a canvas of a paper machine, a spray nozzle used therein and antipollution agent.

BACKGROUND ART

In a manufacturing step (paper making step) of a paper product, it is essential to dry paper (wet paper), and quality of the paper product is very largely affected by whether the drying is good or not.

Accordingly, a dry part (a dry step) of a paper machine is positioned at an extremely important portion in a paper making process.

In the dry part of the paper machine, the paper is generally dried in such a manner as to wind the paper around surfaces of a plurality of heated drier rolls.

Further, in the case of using a plurality of drier rolls, a canvas is generally provided in order to press the paper to the surfaces of the drier rolls from an outer side of the paper so as to increase drying efficiency.

Fig. 1 is a schematic view showing one example of a used mode of the canvas in the dry part of the paper machine (an upper canvas is partly omitted for simplifying).

One canvas A is provided in each of upper and lower sides per a group of about ten drier rolls R (in the case of a double canvas), and is supported by a canvas roll K, a tension roll L, a canvas drier M and the like, and forms a closed loop.

Further, the paper W is pinched between the canvas A and the drier roll R and is strongly pressed to a surface of the heated drier roll R, thereby increasing the drying efficiency of the paper W.

A water vapor evaporated from the paper W is generally

discharged to a drier pocket portion D corresponding to the space surrounded by the drier roll R and the upper and lower canvases A and the like, and is finally exhausted from an exhaust port of a hood covering the dry part on the basis of the ventilation of the drier pocket portion D.

Since the ventilation of the drier pocket portion D affects largely the drying of the paper, it is extremely important.

The ventilation is executed by injecting a hot air through the canvas by a hot air roll, a hot air duct or the like, however, is affected by air permeability of the canvas.

Accordingly, a canvas having suitable air permeability is selectively used.

Further, in a single canvas system (including a single deck such as a verlan or the like) in which the paper is dried by holding a plurality of drier rolls by one canvas, the air permeability of the canvas is important.

If the air permeability is not proper, a phenomenon such as a ballooning, a blowing or the like is generated, and there is a case that a trouble such as the paper is wrinkled or paper cut is generated is caused.

However, since the canvas is strongly brought into contact with the paper, a paper powder, a pitch or the like included in the paper is conversely transferred gradually to a surface of the canvas brought into contact with the paper (which is called as an outer surface of the canvas in the present specification), so that the canvas tends to be polluted (refer to patent document 1).

Further, the paper powder, the pitch or the like enters into an air gap of a weaving of the canvas (a so-called canvas texture) and clogs the texture so as to reduce the air permeability of the canvas, so that the drying efficiency of the paper is significantly lowered.

Further, there is a case that the paper powder, the pitch or the like transferred to the outer surface of the canvas is further transferred to rolls brought into contact with the outer surface of the canvas from the outer surface of the canvas.

In this case, the rolls brought into contact with the outer surface of the canvas mean a tension roll L, a canvas drier M or the like in Fig. 1, and an outer canvas roll N existing in an outer surface side of the canvas in the canvas roll K is included (the rolls brought into contact with the outer surface of the canvas are collectively called as an out roll in the present specification).

If the micro paper powder, the pitch or the like is transferred in sequence to the out roll via the canvas, the paper powder, the pitch or the like are combined with each other on the surface of the out roll, and progressively forms a large block.

Further, if the paper powder, the pitch or the like is accumulated so as to be formed in a layer shape on the surface of the out roll, it is necessary to remove it by stopping the paper machine, so that the manufacturing efficiency is lowered (refer to patent document 1).

Further, there is a case that the block forming a certain level of size is peeled from the surface of the out roll, and is conversely transferred to the outer surface of the canvas.

In this case, not only the canvas is polluted, but also the block is transferred to the paper from the outer surface of the canvas at this time, so that a defect is generated in the paper product or the paper cut is caused.

As mentioned above, if the gradual transfer of the paper powder, the pitch or the like from the paper W and the pollution of the canvas are allowed, various kinds of serious problems as mentioned above are generated.

In order to prevent the matter mentioned above, antipollution agent preventing the paper powder, the pitch or the like from being transferred to the canvas from the paper is generally applied to the canvas.

In conventional, there has been employed a method of directly spraying and applying an emulsion or the like of the antipollution agent to the canvas.

Further, there has been proposed a method of dropping oil emulsion corresponding to the antipollution agent to a rotation shaft from a liquid reservoir container in an upper side of the

canvas so as to scatter and apply as a fine liquid drop on the basis of a centrifugal force of the rotation shaft (refer to patent document 2).

However, in accordance with these methods, the liquid drop of the antipollution agent is easily blown away by a surface layer air current (an accompanying air current) caused by the movement of the canvas, the liquid drop does not reach the canvas surface, and a yield ratio is deteriorated.

Further, the blown away liquid drop is attached to the member or the like of the paper machine so as to become large in the surface thereof, comes down on the paper as the liquid drop (so-called drop in a lump), whereby there is a case that quality of the paper product is significantly deteriorated.

Further, since the surface layer air current of the canvas is extremely violent due to speeding up of the paper machine in recent years, most of the liquid drop is rolled up in these methods, so that there is generated a matter that it is impossible to effectively apply to the canvas surface.

As the other application method, there has been often employed a method of coating the antipollution agent to the canvas via an out roll or the like immersed in the emulsion or the like of the antipollution agent (refer to patent document 3).

However, in accordance with the method mentioned above, since a lot of antipollution agent is applied in many cases, the antipollution agent is clogged in the texture of the canvas, or the canvas gets wet so as to be cogged by the paper powder or the like without the antipollution agent being property applied to the canvas, so that the drying efficiency of the paper has been significantly lowered.

The inventors of the present invention have proposed a method of temporarily applying the antipollution agent to the out roll of the canvas and applying a suitable amount of antipollution agent to the canvas via the out roll, in order to overcome the various kinds of problems mentioned above (refer to patent document 1 and patent document 4).

There have been proposed a method of spraying to the out

roll (particularly, a tension roll) by a fixed type spray nozzle, a method by a slidable type diffusion nozzle, and a method by a long type diffusion nozzle (refer particularly to patent document 1).

However, in accordance with the diffusion method by the fixed type spray nozzle, in the case that a length of the out roll is increased, the antipollution agent tends to be more diffused to a portion near an end portion of the out roll, so that there is a case that it is not necessarily easy to uniformly diffuse to an entire surface of the out roll.

In this point, the long type diffusion nozzle and the slidable type diffusion nozzle can uniformly diffuse to the entire surface of the out roll by optionally determining a number and a sliding width of the nozzle.

However, in accordance with the diffusion method by the long type diffusion nozzle, since a chemical is used by being diluted to some hundreds times by a water, there is a tendency that a spray amount of the antipollution agent is increased in comparison with the case of the slidable type diffusion nozzle.

Further, since the chemical is diffused to portions in both ends of the out roll with which the canvas is not brought into contact, there is a case that the chemical is accumulated in the portions so as to generate a trouble.

In this point, in accordance with the diffusion method by the slidable type diffusion nozzle, the problem mentioned above is not generated, and there is an advantage that the antipollution agent can be uniformly diffused.

Further, it is possible to freely regulate a kind of the used nozzle (for example, a one-fluid nozzle or a two-fluid nozzle), a diffusion amount, sliding speed of the nozzle and the like, and it is suited to a proper spray of the chemical.

In this case, if the one-fluid nozzle is used as the diffusion nozzle, the diffusion amount becomes too much, and the various kinds of problems mentioned above are generated. Accordingly, the two-fluid nozzle is generally employed as the spray nozzle.

However, in the case that the two-fluid nozzle is used, since

kinetic momentum of the sprayed chemical is small, a part of the chemical is rolled up on the basis of the surface layer air current of the out roll and the canvas, so that there is a case that the chemical does not reach the out roll.

Accordingly, the inventors of the present invention has proposed a fluid diffusing fluid scattering prevention apparatus which forms an air curtain in an upstream side and a downstream side of the chemical injecting nozzle and shuts off the surface layer air current so as to spray the chemical by the space therebetween, as an apparatus for preventing the chemical from being rolled up mentioned above (refer to patent document 5).

However, in the apparatus mentioned above, particularly, in the case that paper speed of the paper machine is high speed, there is a case that the air curtain can not necessarily shut off the surface layer air current, but conversely disturbs the surface layer air current largely.

In the case mentioned above, the chemical is rolled up more violently by the disturbed air current, and there is a risk that it is impossible to apply at a predetermined amount, and a problem such as the drop in a lump or the like mentioned above is generated.

(Patent Document 1)

Japanese Unexamined Patent Publication No. 2000-96476 (Figs. 8-10 and 13)

(Patent Document 2)

Japanese Unexamined Patent Publication No. 7-292382 (Page 4 and Fig. 3)

(Patent Document 3)

English Patent No. 2284833 (1995, Fig. 1)

(Patent Document 4)

Japanese Unexamined Patent Publication No. 11-217786 (Figs. 3 and 4)

(Patent Document 5)

Japanese Unexamined Utility Model Publication No. 1-152762

DISCLOSURE OF THE INVENTION

(Problem to be Solved by the Invention)

As mentioned above, the canvas is a member playing an important

part in the drying of the paper which affects largely quality of the paper product, however, since the canvas is directly brought into contact with the paper, the paper powder, the pitch or the like tends to be transferred. Accordingly, if the canvas is polluted, the drying efficiency of the paper is significantly lowered.

In order to prevent the pollution mentioned above, the antipollution agent is applied to the canvas, however, unless the chemical is applied accurately, the texture of the canvas is clogged or the canvas is got wet, so that the drying efficiency is decreased on the contrary.

On the other hand, in order to restrict a flattering that an end portion of the paper traveling inside the paper machine in accordance with an increase of the paper speed, there has been used a canvas manufactured by a monofilament in which air permeability is low, or a canvas manufactured by a multi-filament or a surface layer span or the like in which the texture is woven smaller.

Further, in order to prevent a grace (a concavity and convexity) of the texture of the canvas from being left on the surface of the paper product, there has been used a canvas manufactured by a needle span in which raising coats are provided in the surface of the canvas.

In these canvases, the texture tends to be easily clogged by the paper powder or the like and the antipollution agent and the water content tends to be absorbed, in comparison with the conventional canvas.

In particular, in the canvas in which the air permeability is equal to or less than 20000 $cm^3/cm^2/min$, this tendency is significant.

In view of the application of the antipollution agent to the canvas, an element making the application hard is increased year by year such as the speeding up of the paper speed of the paper machine, a mightiness of the surface layer air current accompanying therewith, an improvement of the canvas as mentioned above, and a condition is going to be severe.

Conversely speaking, it is strongly requested to develop

an application method which can securely apply a proper amount of antipollution agent to the canvas even in the severe environment mentioned above.

The present invention is made for the purpose of overcoming the problem mentioned above against a background of the actual condition mentioned above.

In other words, an object of the present invention is to provide a method of spraying and applying antipollution agent which can securely apply a proper amount of antipollution agent to a canvas.

Further, the other object of the present invention is to provide a diffusion nozzle and a slidable diffusion apparatus which can achieve the spraying and applying method mentioned above.

Further, the other object of the present invention is to provide antipollution agent which is used in the spraying and applying method mentioned above.

(Means for Solving the Problem)

Accordingly, as a result of devoting themselves to research with respect to the objects and backgrounds mentioned above, the inventors of the present invention have found that a proper amount of antipollution agent can be sprayed without being rolled up by the surface layer air current of the canvas by spraying the antipollution agent toward a position (a contact start position) at which the outer surface of the canvas going around the closed loop mentioned above is first brought into contact with the out roll such as the tension roll, the outer canvas roll from the spray nozzle, and have completed the present invention on the basis of the knowledge.

In other words, in accordance with the present invention, there is provided (1) a method of spraying and applying antipollution agent of applying antipollution agent to a canvas used for drying paper in a paper machine, comprising the steps of:

spraying the antipollution agent from a spray nozzle toward a contact start position between an outer surface of a canvas and an out roll;

applying the antipollution agent to the out roll; and

transferring and applying the antipollution agent to the canvas via said out roll.

Further, there is provided (2) a method of spraying and applying antipollution agent, wherein the said out roll is constituted by an out roll which is first brought into contact with after the canvas is apart from the paper.

Further, there is provided (3) antipollution agent spraying method, wherein the antipollution agent is sprayed while sliding the said spray nozzle in parallel to a rotation shaft of the out roll of the canvas.

Further, there is provided (4) a method of spraying and applying antipollution agent, wherein the said canvas is constituted by a canvas in which air permeability is equal to or less than 20000 $cm^3/cm^2/min$.

Further, there is provided (5) a slidable spray apparatus with a spray nozzle used in antipollution agent spraying method described in the item (3), wherein said spray nozzle is constituted by a two-fluid nozzle.

Further, there is provided (6) a slidable spray apparatus with a spray nozzle used in antipollution agent spraying method described in the item (3), wherein said spray nozzle is provided with a two-fluid nozzle for spraying a fluid and an air current injection nozzle for injecting an air current, the air current is injected from the air current injection nozzle to the liquid sprayed from the two-fluid nozzle, and is constituted by a two-fluid nozzle with a secondary blow accelerating and spraying the sprayed fluid by the air current.

Further, there is provided (7) a slidable spray apparatus, wherein the said slidable spray apparatus slides the spray nozzle on the basis of a slidable width set by a limit switch.

Further, there is provided (8) antipollution agent sprayed in accordance with the spraying and applying method described in the item (1), wherein the antipollution agent is constituted by an emulsion including any one or both of oil and wax.

Further, there is provided (9) antipollution agent sprayed in accordance with the spraying and applying method described in

the item (1), wherein the antipollution agent is constituted by an emulsion including a silicone oil.

Further, there is provided (10) antipollution agent sprayed in accordance with the spraying and applying method described in the item (1), wherein the antipollution agent is constituted by an emulsion including a modified silicone oil.

The present invention can of course employ a structure obtained by combining two or more selected from the items (1) to (10) mentioned above, as far as it corresponds to the object.

(Effect of the Invention)

In accordance with the present invention, it is possible to securely apply a proper amount of antipollution agent to the canvas.

It is possible to uniformly and securely apply a proper amount of antipollution agent to the canvas which has not only high air permeability but low air permeability (for example, equal to or less than 20000 $cm^3/cm^2/min$) and is hard to be dried, without applying any extra water content, and the structure is more effective.

Further, it is possible to effectively inhibit the paper powder, the pitch or the like from being transferred to the canvas by using the antipollution agent and the slidable spray apparatus in accordance with the present invention, and a pollution preventing effect can be achieved.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic view showing one example of a used aspect of a canvas in a dry part of a paper machine;

Fig. 2 is a view explaining a contact start position between an outer surface of a canvas and an out roll;

Fig. 3 is a schematic view showing a state in which antipollution agent is sprayed toward the contact start position from a spray nozzle as seen from a side;

Fig. 4 is a schematic view showing a spray position of the antipollution agent in Fig. 1;

Fig. 5 is a schematic view showing an example of a structure of a slidable spray apparatus;

Figs. 6A and 6B are views showing an example of a structure

of a two-fluid nozzle with secondary blow, in which Fig. 6A is a perspective view and Fig. 6B is a cross sectional view along a line X-X in Fig. 6A; and

Fig. 7 is a view showing a state in which the antipollution agent is sprayed from the two-fluid nozzle with secondary blow.

BEST MODE FOR CARRYING OUT THE INVENTION

A description will be given below of a method of spraying and applying antipollution agent to a canvas of a paper machine, a spray nozzle and antipollution agent used therein in accordance with the present invention on the basis of the accompanying drawings, while listing up a preferable embodiment.

(About method of spraying and applying antipollution agent)

Fig. 2 is a view explaining a contact start position between an outer surface of a canvas and an out roll.

Fig. 3 is a schematic view showing a state in which antipollution agent is sprayed toward the contact start position from a spray nozzle as seen from a side.

The spraying method of the antipollution agent in accordance with the present invention is characterized in that antipollution agent T is sprayed toward a contact start position C between an outer surface of a canvas A and an out roll B while sliding a spray nozzle S.

In this case, the contact start position C corresponds to a position at which the outer surface of the canvas A going around a closed loop is first brought into contact with the out roll B, and corresponds to slash hatching position in Fig. 2.

In the drawing, the canvas A moves at high speed toward a lower side from an upper side, and the out roll B rotates at high speed in correspondence to the movement of the canvas A.

Accordingly, a surface layer air current is generated in a direction an outline arrow in Fig. 3 near the surface of the canvas A, and the surface layer air current is generated in a direction of a dotted arrow in Fig. 3 near the surface of the out roll B.

In a method of spraying and applying antipollution agent in accordance with the present invention, as shown in Fig. 3, the

antipollution agent T is sprayed to the contact start position C from the spray nozzle S.

When spraying in the manner mentioned above, the antipollution agent T is carried by both the surface layer air currents of the canvas A and the out roll B so as to be sprayed.

On the other hand, since the surface layer air current of the out roll B is generated, the antipollution agent T is focused by both the surface layer air currents in a spray state, and can accurately reach the contact start position C.

Of course, the antipollution agent T is efficiently applied without being scattered in a wide range.

When spraying at a conventional spray position Sa, the antipollution agent T is cut off by the surface layer air current (the dotted arrow) of the out roll B, and a part of the antipollution agent T is rolled up, so that the antipollution agent T is not efficiently applied to the out roll B.

In order to cover this yield rate lowering component, for example, if the spray amount of the antipollution agent T is increased in the spraying by a long type spray nozzle, a spray amount of a dilution water is increased, and the canvas is wetted more than necessary.

In accordance with the present invention, since the antipollution agent T is sprayed in a collision region between the surface layer air current of the out roll B and the surface layer air current of the canvas A, the surface layer air current is conversely utilized positively.

In other words, the spray state is focused, and it is possible to make the antipollution agent T to reach the contact start position C without being rolled up.

In this case, a description will be given of a principle of a method of spraying and applying antipollution agent in accordance with the present invention.

A method of spraying and applying antipollution agent in accordance with the present invention is structured such as to spray the antipollution agent toward the contact start position between the outer surface of the canvas and the out roll from the

spray nozzle mentioned above, make the antipollution agent to be attached to the out roll and apply the antipollution agent to the canvas by utilizing the matter that this antipollution agent is transferred to the canvas from the out roll.

As shown in Fig. 1, the canvas A is brought into pressure contact with a plurality of drier rolls R heated, for example, at about 80 to 100 ℃ via the paper W, and on the other hand, is directly heated and dried by a canvas drier M.

Accordingly, the canvas A travels in a high temperature state, and a tension roll L and an outer canvas roll N (that is, an out roll) brought into contact therewith are always transferred a heat from the drier roll R and the canvas drier M via the canvas A, and rotate in a high temperature state.

When spraying and applying the antipollution agent to the out roll having the high temperature as mentioned above, an extra water content in the antipollution agent is evaporated, however, wax, oil or the like in the antipollution agent is oiled by the heat so as to become small in a viscosity, and is diffused to the surface of the out roll so as to form an oil film.

Further, a part of the oil film is transferred to an entire of the outer surface of the canvas A from the out roll as if paint is applied to a wall by a roller, whereby it is possible to achieve a uniform application of the oil or the like to the outer surface of the canvas (paint roller effect).

Further, since a proper amount of oil or the like is uniformly applied only to the surface layer portion of the outer surface of the canvas in the high temperature state, a thin oil film is effectively formed in the surface of the canvas without wetting the canvas or clogging the texture of the canvas.

Since the oil film is formed in the canvas in the manner mentioned above, it is possible to sufficiently effectively prevent the paper powder, the pitch or the like from being transferred from the paper.

Further, since the oil or the like is transferred only to the surface layer portion of the canvas in the manner mentioned above, it is possible to correspond to any canvas such as a canvas

generally used in the paper machine, that is, of a plain weave, a double cloth, a triple cloth, a needle type, a spiral type, a surface layer span type or the like obtained by combining a monofilament, a multifilament and the like.

In other words, as previously described, in accordance with the conventional method, in the canvas having the air permeability equal to or less than 20000 $cm^3/cm^2/min$, the clogging of the canvas is frequently generated by the paper powder, the oil of the antipollution agent and the like, or the extra water content is absorbed so as to significantly generate an easily wetting tendency.

However, in accordance with the present invention, since it is possible to transfer the oil or the like only to the surface layer portion of the canvas on the basis of the paint roller effect as mentioned above, it is possible to apply the antipollution agent without any trouble, even in the canvas mentioned above.

A method of spraying and applying antipollution agent in accordance with the present invention corresponds to a method of accurately supplement the oil or the like (the antipollution agent) of the oil film which is lost at a small amount from the surface of the out roll on the basis of the paint roller effect mentioned above by a proper amount.

The applying of the antipollution agent as mentioned above can be executed by using a long type spray nozzle having a plurality of nozzle ports.

However, as previously mentioned, in the case of spraying the antipollution agent by the long type spray nozzle, since the chemical is generally used by being diluted at some hundreds times, there is a case that a lot of water content is transferred to the canvas if the canvas becomes wet by simultaneously spraying to an entire of the surface of the out roll in every hole and corner.

In this point, in a slidable type spray nozzle spraying while sliding one spray nozzle in parallel to the out roll, since the antipollution agent is sprayed as a concentrate solution without being diluted by the water, it is possible to securely inhibit the canvas from getting wet, and the structure is preferable.

A spray amount of the antipollution agent with respect to

the out roll is changed by various kinds of factors such as paper speed, a material and a width of the canvas, a number of the out roll, a kind of the paper product, a number and a temperature of the drier roll held by said canvas, and the like.

However, in accordance with the present invention, in the case of spraying by the spray nozzle (the long type spray nozzle or the slidable type spray nozzle) as mentioned above, it is possible to immediately and accurately execute the fine adjustment as mentioned above, by changing the spray amount and the sliding speed or replacing the spray nozzle.

Further, as shown in Fig. 3, when spraying toward the contact start position between the outer surface of the canvas and the out roll, there is a case that a part of the antipollution agent (the oil, the water or the like) is applied to the canvas, however, since the part of the antipollution agent is brought into contact with the out roll in a moment of time, it is possible to obtain the same effect as that obtained by directly spraying an entire amount to the out roll.

Further, since the water content in the directly applied partial antipollution agent is at such a level that can be immediately dried by being brought into contact with the out roll, the canvas drier, the drier roll or the like, the oil film formation on the surface of the canvas is not affected.

In this connection, the oil of the antipollution agent transferred to the canvas from the out roll (for example, the tension roll) is carried to the canvas, and a part thereof is transferred to the paper and the other out roll (for example, the canvas drier or the outer canvas roll) so as to be attached.

The oil attached to the other out roll forms the oil film on the surface of the roll.

However, if not only the oil is unilaterally continuously supplied from the canvas, but also the oil is accumulated at a certain degree, the oil is conversely transferred to the canvas from the other out roll this time.

In the manner as mentioned above, the exchange of the oil between the other out roll and the canvas reaches a balance, and

a state in which the oil film is held on the surface thereof at a fixed thickness is kept.

Further, the oil transferred to the paper is carried by the paper and is finally removed from the paper machine together with the paper.

Accordingly, it is necessary to continuously supply the antipollution agent to the out roll at that degree.

As mentioned above, in a state in which a proper amount of antipollution agent (the oil or the like) is sprayed, if the antipollution agent is sprayed to one out roll, the oil film is formed not only in this out roll but also in the other out roll.

Further, as a result, it is possible to protect all the out roll from the pollution by the paper powder, the pitch or the like caused from the paper.

(About Spray Position of Antipollution Agent)

In accordance with a method of spraying and applying antipollution agent on the basis of the present invention, as is different from the conventional art which sprays the antipollution agent against the surface layer air current of the canvas and the out roll (refer to Sa shown by a broken line in Fig. 3), it is possible to make good use of the surface layer air current thereof as mentioned above.

In other words, it is possible to achieve the object of securely apply a proper amount of antipollution agent to the canvas (via the out roll), by carrying the antipollution agent on the surface layer air current so as to accurately make the antipollution agent to reach the contact start position.

Further, since the idea of carrying this antipollution agent on the surface layer air currents of the canvas and the out roll actually generates a new advantageous effect, a description will be given here.

A conventional spraying and applying method (refer to Sa in Fig. 3) tends to be disturbed by the surface layer air current of the canvas or the out roll as previously mentioned, and can be actually executed only by the out roll which is in a deep drawn state such as the tension roll L (a position S5 in Fig. 4).

On the contrary, in accordance with the spraying and applying method on the basis of the present invention, as later certified by the embodiment, it is known that the function can be sufficiently achieved even in the out roll (refer to S1 with respect to the outer canvas roll N and S3 with respect to the canvas drier M in Fig. 4) which tends to be affected by the surface layer air current of the canvas or the like and is shallowly drawn such a level as being pressed to the canvas.

In other words, in accordance with the present invention, it is possible to accurately spray the antipollution agent to the out roll which is shallowly drawn and is hard to be achieved in the conventional method, without being rolled up the antipollution agent.

Accordingly, the present invention has an advantage that the present invention can be applied to any out roll.

Further, as mentioned above, (the oil of) the antipollution agent sprayed to the out roll is transferred to the other out roll via the canvas, forms the oil film so as to inhibit the out roll from being polluted, and further prevents the canvas from being polluted.

Accordingly, in the case that a plurality of out rolls are provided, if the antipollution agent is applied to the out roll positioned in an upstream side of a moving direction of the canvas, the antipollution agent (the oil) is transferred to the other out roll in a downstream side, whereby it is possible to effectively prevent the pollution.

In other words, in accordance with the spraying and applying method on the basis of the present invention, it is preferable to spray the antipollution agent to the out roll (the outer canvas roll N in Fig. 4) which the canvas is apart from the paper and is first brought into contact with.

(About Slidable Spray Apparatus)

In a method of spraying and applying antipollution agent in accordance with the present invention, it is possible to employ the long type spray nozzle, however, since the chemical is used by being diluted by the water at some hundreds times as previously

mentioned, there is a case that the canvas gets wet.

In this point, in the case of the slidable type spray nozzle, there is an advantage that the antipollution agent can be sprayed as the concentrate solution without being diluted by the water.

Accordingly, a description will be first given of a slidable spray apparatus for sliding the spray nozzle.

Fig. 5 is a schematic view showing an example of a structure of the slidable spray apparatus.

In this example of the structure, there is shown a case that the spray nozzle is constituted by a two-fluid nozzle.

A slidable spray apparatus 1 is provided with a frame body 11, left and right box portions 12L and 12R, a spray nozzle S, a moving belt 13 for fixing and sliding (reciprocating movement) the spray nozzle S, a drive motor 14, left and right limit switches 15L and 15R, and the like.

The spray nozzle S is fixed and supported to a support body 16 raised from a support table 13a attached and fixed to the moving belt 13.

A liquid supply tube 17 for supplying the antipollution agent and an air supply tube 18 for blowing are attached to the spray nozzle S, and lower ends thereof are fitted and fixed to the support table 13a.

The liquid supply tube 17 and the air supply tube 18 are coupled to respectively corresponding tubes 17a and 18a in an inner side of the frame body 11.

The tubes 17a and 18a are inserted to a cable bear 19 flexibly changing its shape in correspondence to a reciprocating movement of the moving belt 13 so as to follow, and are coupled to a chemical tank, a compressor or the like (not shown) in an external portion of the apparatus through an inner side of the left box portion 12L.

The moving belt 13 provided in a tensional manner between a roller within the right box portion 12R and a roller driven by the drive motor 14 within the left box portion 12L (none of the rollers being illustrated).

The frame body 11 is provided with limit switches 15L and

15R in left and right sides, and it is possible to set a sliding width of the spray nozzle S by these limit switches.

In other words, in this slidable spray apparatus 1, it is possible to reciprocate (slide) the spray nozzle S in a longitudinal direction of the slidable spray apparatus 1 on the basis of the sliding width set by the limit switch, by driving the drive motor 14 so as to move the moving belt 13 in a forward direction or a backward direction.

Accordingly, it is possible to prevent the chemical from being sprayed to the portion with which the canvas is not brought into contact in both ends of the out roll to the utmost, and the chemical is not accumulated in the portion so as to generate the trouble as is different from the prior art previously mentioned.

Further, the flexible tubes 17a and 18a coupled to the liquid supply tube 17 or the air supply tube 18 can follow the deformation of the cable bear 19.

Accordingly, it is possible to continuously supply the antipollution agent and the air for blowing during the time when the spray nozzle S slides, and the spray nozzle S can continuously spray the antipollution agent while sliding.

(About Spray Nozzle)

Next, a description will be given of the spray nozzle.

As the spray nozzle S, a one-fluid nozzle or a two-fluid nozzle is generally employed.

The one-fluid nozzle is structured such as to inject by applying a pressure to the liquid, and is characterized in that an amount of the injected liquid is much and an impact (flow speed, kinetic momentum or the like) of the liquid is great.

The two-fluid nozzle is structured such as to spray by extruding the liquid by a blow air, and is characterized in that the nozzle is suitable for spraying a small amount of liquid, however, the impact is comparatively small.

In the spraying and applying of the antipollution agent to the canvas, as previously mentioned, it is an essential condition that the drying efficiency of the paper by the canvas is not lowered, and it is necessary to apply such an amount of antipollution agent

as not to make the canvas to get wet and not to clog the texture of the canvas.

Accordingly, it is preferable to make an amount of the water diluting the antipollution agent as small as possible, and it is further preferable to spray the antipollution agent as the concentrate solution without being diluted by the water. Therefore, in the slidable spray apparatus in accordance with the present invention, it is preferable that the two-fluid nozzle is used as the spray nozzle.

At this time, various kinds of two-fluid nozzles have been developed and supplied on market, however, it goes without saying that the two-fluid nozzle is appropriately selected or designed on the basis of the spray amount or the like of the antipollution agent.

(About Two-fluid Nozzle with Secondary Blow)

Since the spraying and applying method in accordance with the present invention is structured, as previously mentioned, such as to apply the antipollution agent together with the surface layer air current of the canvas or the out roll, it is possible to sufficiently apply the antipollution agent without being rolled up even in the case of using the two-fluid nozzle.

However, in the case that the paper speed of the paper machine is speeded up very much, and the surface layer air current of the canvas or the like (refer to an outline arrow and a dotted arrow in Fig. 3) is violent, a two-fluid nozzle with secondary blow can be used as the spray nozzle for making the antipollution agent to more securely reach the canvas.

The two-fluid nozzle with secondary blow is provided with a two-fluid nozzle for spraying the liquid (the antipollution agent), and an air current injection nozzle for injecting the air (the secondary blow), and is structured such as to inject the air current from the air current injection nozzle to the liquid sprayed from the two-fluid nozzle, and accelerate the sprayed liquid by the air current so as to spray to the canvas.

Figs. 6A and 6B are views showing an example of a structure of the two-fluid nozzle with secondary blow, in Fig. 6A is a

perspective view and Fig. 6B is a cross sectional view along a line X-X in Fig. 6A (in Fig. 6B, the two-fluid nozzle is shown by a broken line).

An arrow in Fig. 6B shows a flow of the secondary blow air.

In the present example of the structure, the two-fluid nozzle 2 with secondary blow is provided with a two-fluid nozzle 3 and an air box 4, and the two-fluid nozzle 3 is fitted and fixed by screw to the air box 4 having an approximately C shape (not shown).

The two-fluid nozzle 3 is provided with a spray nozzle 31, a liquid injection port 32 and an air injection port 33.

The two-fluid nozzle 3 (the spray nozzle 31) is appropriately selected on the basis of a spray amount of the antipollution agent or the like in the same manner as the two-fluid nozzle previously mentioned so as to be used.

Further, a liquid supply tube 17 (refer to Fig. 5) is screwed with the liquid injection port 32, and an air supply tube 18 is screwed to the air injection port 33, respectively via a sealing.

A recess portion is formed in an inner side of a side wall 41 of the air box 4, and an air current spray nozzle 42 surrounded by said side wall 41 and a side wall of the two-fluid nozzle 3 is formed.

A secondary blowing air supply tube 21 for supplying the air for a secondary blow is screwed with a secondary blowing air injection port 43 in a bottom portion of the air box 4 via a sealing, in place of a support body 16 in Fig. 5.

Although an illustration is omitted, it goes without saying that the secondary blowing air supply tube 21 is fitted and fixed to the support body 13a in the same manner as the liquid supply tube 17 or the like, is coupled to the tube, is inserted to the cable bear, and is coupled to the compressor or the like in the external portion of the apparatus.

The two-fluid nozzle 2 with secondary blow having the structure mentioned above is attached as the spray nozzle S to the slidable spray apparatus 1 shown in Fig. 5 so as to be used.

When supplying a compressed air (the air for the secondary blow) to the two-fluid nozzle 2 with secondary blow having the

structure mentioned above from the secondary blowing air supply tube 21, the compressed air passes through the secondary blowing air injection port 43, fills in the space 44, is injected from the air current injection nozzle 42 through a hole 45, and forms a secondary blow E.

Fig. 7 is a view showing a state in which the antipollution agent is sprayed from the two-fluid nozzle with secondary blow.

It can be easily understood from Fig. 7 that when injecting the secondary blow E from the air current injection nozzle 42 to the antipollution agent T sprayed from the spray nozzle 31 of the two-fluid nozzle 2 with secondary blow, the antipollution agent T is accelerated to the secondary blow E having higher flow speed.

In the manner mentioned above, the two-fluid nozzle with secondary blow can make the injection of the fluid achieved by the two-fluid nozzle which is originally weak in the impact stronger in the impact.

(About Antipollution Agent)

As the antipollution agent used in a method of spraying and applying antipollution agent in accordance with the present invention, there can be listed up wax, oil or an emulsion including both of them.

Since the wax and the oil tend to be oiled in the surface of the out roll so as to be diffused, and can form an oil film having a more effective water repellent, the wax and the oil can be preferably used as mold release agent.

Among them, since vegetable oil such as castor oil, rapeseed oil or the like has an improved fixing ability on the canvas and the out roll, and does not obstruct paper printing property, the vegetable oil is preferably used as the antipollution agent.

Further, since silicone oil forms a coat having a mold releasing property and a water repellent peculiar to the silicone oil on the surface of the canvas or the out roll, the silicone oil is preferably used as a main component of the antipollution agent.

Various kinds of oil can be employed in the silicone oil.

Among them, since dimethyl polysiloxane group oil (so-called

"dimethyl") is characterized in that a number of kinds is very large, and can be appropriately selected in correspondence to the used condition such as a material of the canvas, a temperature at a time of being used, or the like so as to be used, it is preferable.

Further, in addition to the dimethyl polysiloxane group oil mentioned above, a modified silicone oil in which a lateral chain or an end group is variously replaced by the other organic functional groups is supplied as the silicone oil on market, and is preferably used.

The modified silicone oil includes various kinds of modified types, for example, an amino denaturation, an epoxy denaturation, an alkoxy denaturation, a carboxy denaturation, a carbinol denaturation, a mercapto denaturation and the like, on the basis of the substituent group.

Further, the modified silicone oil is divided into a side chain type, a both end type, a one end type, a side chain and both end type and the like on the basis of the replaced position, and has a peculiar characteristic in correspondence to combinations of the replaced position, the modified type mentioned above and the like.

For example, when carrying out an experiment that the side chain type amino modified silicone oil is attached to an acryl plate and wiped out by a tissue paper, the side chain type amino modified silicone oil has a characteristic of being hard to be wiped out (which is not generally wiped out by one time and leaves the oil film) in comparison with the dimethyl (which is nearly wiped out only by wiping out once).

In other words, the side chain type amino modified silicone oil has a characteristic that an adhesive property (a fixing property) is strong in comparison with a plastic, and is actually adhered strongly to a synthetic fiber and a metal plate.

It is considered that this is because the organic functional group having a polarity of the side chain is strongly attracted to a metal plate or the like and achieves an anchor effect with respect to the surface of the metal plate or the like.

If the modified silicone oil as mentioned above is used in

the spraying and applying method of the antipollution agent in accordance with the present invention, the modified silicone oil which is once attached to the canvas or the out roll is strongly adhered to them and is not easily detached from them. Accordingly, the modified silicone oil is preferable.

Further, since the oil is transferred to the paper as previously mentioned and the removed amount is reduced, on the basis of the characteristic mentioned above, there is an advantage that it is possible to make an application amount of the antipollution agent smaller.

Accordingly, it is possible to securely prevent the problem such as the clogging of the canvas or the like.

Further, since the modified silicone oil is accurately attached to the canvas just after starting the application of the antipollution agent and immediately forms the oil film in the out roll, on the basis of the strong adhesive property thereof, there is an advantage that it is very fast to generate the antipollution effect (so-called raising).

The spray amount of the antipollution agent is determined in correspondence to the condition such as the material and the width of the canvas, the number and the temperature setting of the drier roll, the kind of the manufacture paper product, the paper speed, the material and the temperature at use of the sprayed out roll, the main component (the wax, the oil, the silicone oil and the modified silicone oil) of the antipollution agent and the like, as previously mentioned.

(Embodiments)

A description will be given below of embodiments.

It goes without saying that the present invention is not limited to these embodiments.

(Antipollution Agent)

The antipollution agent (the emulsion) is prepared in the following manner.

(Modified) silicone oil or castor oil 10 weight %

Emulsifying agent

(Emulgen109P (manufactured by Kao Corporation,

Polyoxyethylene Lauryl Ether, Nonionic group)) 2 weight %

Water 8 weight %

Total 100 weight %

(Paper Condition)

Paper machine: Ultra former (manufactured by Kobayashi Engineering Works, Ltd.)

Paper Name: Liner

Basic Weight: 160 g/m2

Paper Speed: 650 m/min

Paper Width: 4 m

Canvas Width: 4.5 m

In this case, the air permeability of the used canvas is 16000 $cm^3/cm^2/min$.

The out roll is arranged as shown in Fig. 4, in the order of the outer canvas roll N, the tension roll L and the canvas drier M from an upstream side of the canvas.

(Spray Condition)

The spray was executed for an actual working hours of fourteen days by using the slidable spray apparatus shown in Fig. 5 (in which the spray nozzle is constituted by the two-fluid nozzle), setting the spray amount of the antipollution agent to 5 cm^3/min, and changing the sliding speed, the spray position (S1 to S6 in Fig. 4) and the kind of the silicone oil.

In this connection, in Fig. 4, reference symbols S1, S2 and S3 show a case of spraying toward the contact start position between the outer surface of the canvas and the out roll in accordance with the present invention, reference symbols S4 and S5 show conventional spray positions spraying to the out roll, and reference symbol S6 shows a case of directly spraying to the outer surface of the canvas, respectively.

In this connection, the spray amount 5 cm^3/min component of the antipollution agent corresponds to the spraying of the oil

component 0.19 mg/m^2 in the case of setting a specific gravity of the emulsion to 1.0 g/cm^3.

Just for reference, a calculation formula is shown.

(Calculation Formula) 5 cm^3/min × 0.1 × 1.0 g/cm^3 ÷ (650 m/min × 4.0 m)

= 0.5 g/min ÷ 2600 m^2/min

= 500 mg/min ÷ 2600 m^2/min

= 0.19 mg/m^2

(Result and Evaluation)

A result is shown in (Table 1).

In Table 1, the sliding speed shows sliding speed of the spray nozzle.

Further, reference symbols N, L and M denote the outer canvas roll N, the tension roll L and the canvas drier M in Fig. 4, respectively.

At this time, an evaluation is executed on the basis of a visual observation, and is classified as follows.

◎: No dirty (the paper powder, the pitch or the like) can be confirmed in the canvas or the out roll.

○: The dirty is slightly attached to the canvas or the out roll.

△: The dirty is attached to the canvas or the out roll.

×: The texture of the canvas is clogged, or the dirty is formed in the out roll in a laminated manner.

Table 1

	Spray position	Sliding speed (m/min)	Main component of antipollution agent	Evaluation			
				N	L	M	Canvas
Embodiment 1	S1	4.5	Dimethyl	◎	◎	◎	◎
Embodiment 2	S1	3.0	Dimethyl	◎	◎	◎	◎
Embodiment 3	S1	2.0	Dimethyl	◎	○	○	○
Embodiment 4	S1	2.0	Amino modification	◎	◎	◎	◎
Embodiment 5	S2	4.5	Dimethyl	○	◎	◎	○
Embodiment 6	S3	4.5	Dimethyl	○	○	◎	○
Embodiment 7	S1	4.5	Castor oil	◎	◎	◎	◎
Embodiment 8	S1	1.0	Dimethyl	○	△	△	△
Embodiment 9	S1	1.0	Amino modification	◎	○	△	△
Comparative embodiment 1	S4	4.5	Dimethyl	△	×	×	×
Comparative embodiment 2	S5	4.5	Dimethyl	×	○	△	△
Comparative embodiment 3	S6	4.5	Dimethyl	×	×	×	×

(Case of changing sliding speed of spray nozzle)

In the spraying method in accordance with the present invention, it is preferable that the sliding speed of the spray nozzle is equal to or more than 1.5 m/min.

In other words, as shown in the embodiments 1 to 3, the embodiment 8, the embodiment 4 and the embodiment 9, comparing a case of changing the sliding speed of the spray nozzle at the position S1 in Fig. 4 and spraying the dimethyl silicone oil (the dimethyl polysiloxane group oil), it is known that the smaller the sliding speed is, the more the dirty is attached to the canvas or the like.

Further, it is known that if the sliding speed is smaller than 2.0 m/min, a lump of the small dirty starts being generated in the canvas or the like.

It is considered that this is because the oil supplement is too late for reducing and wearing away of the oil film of the out roll if the sliding speed of the spray nozzle is too small.

In other words, the oil film is peeled off one after another in the portion to which the antipollution agent is not sprayed in the surface of the out roll, and the canvas can not be efficiently supplied the oil from the portion of the out roll, and the oil film can not be efficiently formed in the surface of the canvas.

Accordingly, the transfer of the paper powder, the pitch or the like from the paper is allowed, and the paper powder or the like is carried by the canvas so as to be transferred to the other out roll and the out roll is polluted.

In accordance with the matter mentioned above, it can be understood that the sliding speed of the spray nozzle affects to prevent the canvas or the like from being polluted.

(Case of using modified silicone oil)

This tendency is the same as a case that the side chain type amino modified silicone oil is used in place of the dimethyl (embodiments 4 and 9).

However, as is known by comparing the embodiment 3 with the embodiment 4 (and the embodiment 8 and the embodiment 9), the antipollution effect is better in the case of using the modified

silicone oil than in the case of the dimethyl at the same sliding speed, and an improvement is acknowledged.

(Case of changing spray position)

Comparing the spray position of the antipollution agent to S1 (embodiment 1), S2 (embodiment 5), S3 (embodiment 6), S4 (comparative embodiment 1), S5 (comparative embodiment 2) and S6 (comparative embodiment 3), the antipollution effect was good in the positions S1 to S3 sprayed by the spraying and applying method in accordance with the present invention.

In the position S4, the roll-up of the liquid drop of the antipollution agent was observed.

The antipollution effect in the position S4 is hardly confirmed because it is considered that a sufficient amount of antipollution agent did not reach the outer canvas roll N due to the violent roll-up by the surface layer air current of the canvas.

In the position S5, it was observed that a part of the liquid drop of the antipollution agent is rolled up.

In the case of comparing with the case of S4 mentioned above, since an amount of the roll-up was small, a better result could be obtained.

However, in the case of comparing with the embodiment 5 sprayed in the position S2, it is not said that the antipollution effect is sufficient. As a result of being rolled up as mentioned above, the amount reaching the tension roll L was reduced, and it is assumed that the amount did not reach a necessary amount.

When directly spraying the antipollution agent to the canvas in the position S6, both the canvas and the out roll were seriously polluted.

At this time, the antipollution agent was violently rolled up.

Although not being shown in Table 1, a case of using the emulsion of the side chain type amino modified silicone oil in place of the dimethyl had the same result.

Further, the same experiment was executed by using the two-fluid nozzle with secondary blow in place of the two-fluid nozzle. In this case, while it was possible to restrict most of

the rolling up, however, the canvas and the out roll were polluted in the same manner.

In other words, in the case of directly spraying to the canvas, the antipollution agent (the oil, the water and the like) is absorbed on the spot even if the antipollution agent reaches the canvas, and the antipollution agent is not diffused in a surface direction.

Accordingly, the oil in the canvas portion to which the antipollution agent is not sprayed is transferred to the paper so as to be lost, and the transfer of the paper powder, the pitch or the like is conversely allowed so as to pollute (in other words, the paint roller effect at a time of spraying to the out roll can not be obtained).

Further, since no effective oil film is formed in the out roll, it is considered that the power powder or the like is transferred from the canvas one after another so as to be accumulated.

(More effective spray position)

The embodiment 1, the embodiment 5 and the embodiment 6 correspond to cases in which only the spray position of the antipollution agent by the spraying and applying method in accordance with the present invention is changed.

From the results, the following matters are known:

(1) the oil film is formed in the out roll to which the antipollution agent is sprayed, and the oil is carried to the out roll in the downstream thereof via the canvas, thereby effectively forming the oil film; and

(2) however, there is a case that the out roll existing in the upstream side of the out roll to which the antipollution agent is sprayed is slightly polluted by the paper powder, the pitch or the like.

Considering these reasons of the above items, the item (1) can be easily understood from the principle of a method of spraying and applying antipollution agent in accordance with the present invention previously mentioned.

Further, the item (2) can be considered to be caused by a matter that if the canvas is brought into pressure contact with

the paper, a part of the oil is transferred to the paper as previously mentioned, so that the amount of the oil transferred to the out roll positioned just after it (the out roll in the upstream side mentioned above) becomes small, and the antipollution effect is slightly lowered.

Further, if the canvas is brought into pressure contact with the paper, there is a case that the paper powder, the pitch or the like is transferred by accident.

The paper powder or the like mentioned above is generally transferred to the paper from the canvas so as to be returned during the time when the canvas goes around, and the canvas or the like is not polluted, however, it is considered that since a part of the paper powder or the like is transferred to the out roll in which the antipollution effect is slightly lowered as mentioned above so as to be trapped, the out roll is slightly polluted.

Accordingly, in the spraying and applying method in accordance with the present invention, it is possible to effectively prevent the pollution of all the out rolls by spraying the antipollution agent to the out roll which the canvas is apart from the paper body and is first brought into contact with.

Further, as is known by comparing the embodiment 3 with the embodiment 4, it is more effective to employ the modified silicone oil.

(Case of using vegetable oil)

In the case of using the castor oil as a main component of the antipollution agent (the embodiment 7), the dirty (the paper powder, the pitch or the like) was not confirmed in the canvas and the out roll, and the improved result could be obtained, in the same manner as the case of using the dimethyl silicone oil (the embodiment 1).

It is considered that this is because the castor oil is fixed to the surface of the canvas or the out roll so as to effectively form the oil film, and effectively inhibit the paper powder, the pitch or the like from being transferred, in the same manner as the case of the dimethyl or the side chain type amino modified silicone oil.

(Air permeability of canvas)

A description will be finally given of air permeability of the canvas.

In the conventional spraying method, as mentioned already, the clogging of the canvas was frequently generated by the paper powder, the oil of the antipollution agent or the like, in the canvas in which the air permeability is equal to or less than 20000 $cm^3/cm^2/min$, or there was the tendency of easily getting wet by absorbing the extra water content.

The present invention can solve the matter mentioned above, and can rather achieve a more excellent effect in a range of the air permeability.

In order to verify the matter, the spray experiment for an actual working hour of fourteen days was executed by using a canvas having a different condition 25000 cm^3/cm^2 from the canvas having the paper condition in the embodiments previously mentioned (that is, 16000 $cm^3/cm^2/min$), and setting the other conditions to be the same.

In this case, the spray position employs S2 (embodiment 10) and S5 (comparative embodiment 4) in the tension roll L.

The result is shown in (Table 2).

It is understandable that the spraying method in accordance with the present invention can achieve an excellent effect in accordance that the air permeability becomes rather smaller, from the results of the embodiment 5, the embodiment 10, the comparative embodiment 2 and the comparative embodiment 4.

Accordingly, it is preferable for manufacturing a fine thin paper.

Embodiment 10	S2	4.5	Dimethyl	○	◎	○	○
Comparative embodiment 4	S5	4.5	Dimethyl	×	○	△	△

The description is given above of the present invention, however, it goes without saying that the present invention is not limited only to the embodiment, and the other various modified embodiments can be employed within the scope of the present invention.

For example, in the present invention, the description is given mainly of the two-fluid nozzle, however, it is of course possible to use the one-fluid nozzle in some cases.

Further, with respect to the modified silicone oil, the present specification mainly takes up the side chain type amino modified silicone oil, however, this is one example to the end, and it is of course possible to use the oil on the basis of the other substituent group and the oil in the other substitution position.

Further, in a canvas (an inner roll type) of a type in which all the canvas rolls including the tension roll or the like are provided in an inner side, the present invention can be executed for example by pressing the canvas roll from an outer side of the canvas.

INDUSTRIAL APPLICABILITY

A method of spraying and applying antipollution agent to the canvas of the paper machine, the slidable spray apparatus used therein and the antipollution agent in accordance with the present invention can be utilized in a general technical field of paper industry as far as the principle is applied, without being limited to the paper machine.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic view showing one example of a used mode of a canvas in a dry part of a paper machine;

Fig. 2 is a view explaining a contact start position between an outer surface of a canvas and an out roll;

Fig. 3 is a schematic view showing a state in which antipollution agent is sprayed toward the contact start position from a spray nozzle as seen from a side;

Fig. 4 is a schematic view showing a spray position of the antipollution agent in Fig. 1;

Fig. 5 is a schematic view showing an example of a structure of a slidable spray apparatus;

Figs. 6A and 6B are views showing an example of a structure of a two-fluid nozzle with secondary blow, in which Fig. 6A is a perspective view and Fig. 6B is a cross sectional view along

a line X-X in Fig. 6A; and

Fig. 7 is a view showing a state in which the antipollution agent is sprayed from the two-fluid nozzle with secondary blow.